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14. ABSTRACT

This paper describes the development of a new measure of polychronicity, an individual differences construct indicating a preference for performing multiple tasks at once as opposed to performing only one task at a time. Although empirical research to date has found mixed results with respect to polychronicity's association with multitasking and other related variables, polychronicity remains conceptually promising as a predictor of multitasking-related variables. Following a brief review of past definitional issues, a revised definition is offered, and a new measure of polychronicity—the POLY—is created based on this revised definition. Three studies describe the creation, pilot testing, and psychometric refinement of an initial pool of polychronicity items (Study 1); an initial convergent and discriminant validity analysis (Study 2); and some initial findings with respect to the criterion-related validity of scores on the POLY (Study 3). Together, these findings provide preliminary evidence for the reliability of scores on the POLY and the validity of the POLY in predicting variables relevant to multitasking.

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Measure development, polychronicity, multitasking, preference, personality, interests.

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Foreword

Whole Person Assessment (WPA) reflects a multifaceted effort on the part of Navy Personnel Research, Studies, and Technology (NPRST/BUPERS-1) to research and develop a suite of tools that show promise in improving the selection and classification of Sailors in the U.S. Navy. WPA has been motivated by a recognized disparity: operational selection and classification in the U.S. Navy is driven in large part by the recruitment interview in tandem with scores from the Armed Services Vocational Aptitude Battery (ASVAB), yet Navy jobs and Sailor performance both contain critical elements that are non-cognitive in nature and may be better understood and predicted by measures other than the ASVAB (e.g., measures of motivation, personality, and interests).

With this broad context in mind, this report documents the development and testing of a brief measure of polychronicity, an individual differences characteristic reflecting an individual's preference for multitasking (vs. performing only one task at a time). Multitasking has become an important consideration in the work of Sailors in the 21st century. The new measure, called the POLY, is shown to be useful for predicting outcomes such as enjoyment of multitasking and the choice to multitask again. As such, it is important to note that the POLY measure reflects interest in multitasking, rather than multitasking ability itself; therefore the measure would best serve as a classification tool or as a selection tool when the outcome to be predicted is satisfaction or turnover in jobs requiring multitasking. The POLY could then supplement other non-cognitive measures that have already established promise as classification tools, such as FLEET/RIDE and Navy Computer-Adaptive Personality Scales (NCAPS), to meaningfully differentiate Sailor job preferences along this important dimension of multitasking.

The POLY was developed in three separate studies. In the first study, subject matter experts (SMEs) generated a large pool of potential items, a pool that was then reduced and tested on a pilot sample of university students. In the second study, the convergent and discriminant validity of the POLY was empirically tested by correlating it with measures of other constructs thought to be similar or distinct in nature. In the third study, the criterion-related validity of the POLY was tested. In this study, university students performed a computerized multitasking simulation called SynWin, which required them to perform four computerized tasks simultaneously. Results indicated that the POLY showed high test-retest and internal consistency reliability as well as acceptable content, face, and convergent/discriminant validity. With respect to criterion-related validity, scores on the POLY predicted enjoyment of this task and the choice to multitask again in the future. These findings indicate that the POLY may be useful as a tool for predicting outcomes like satisfaction or turnover within jobs that require multitasking, and it appears to be of use when gauging Sailor preferences for jobs that require more (or less) multitasking. This report covers the studies involved in the development of the POLY, including all steps in measure development and

validation. The POLY is a measure that is very short to take and yields practically useful results for selection and classification. It is a product of the overarching SYRUS project, which has generated a series of both lab and field studies informing Sailor multitasking performance.

The research was sponsored by the Office of Navy Research (Code 34) and funded under PE 0602236N and PE 0603236N.

David L. Alderton, Ph.D.
Director

Summary

This paper describes the development of a new measure of polychronicity, an individual differences construct indicating a preference for performing multiple tasks at once as opposed to performing only one task at a time (e.g., Slocombe & Bluedorn, 1999). Although empirical research to date has found mixed results with respect to polychronicity's association with multitasking and other related variables, polychronicity remains conceptually promising as a predictor of multitasking-related variables. Following a brief review of past definitional issues, a revised definition is offered, and a new measure of polychronicity—the POLY—is created based on this revised definition. Three studies describe the creation, pilot testing, and psychometric refinement of an initial pool of polychronicity items (Study 1); an initial convergent and discriminant validity analysis (Study 2); and some initial findings with respect to the criterion-related validity of scores on the POLY (Study 3). Together, these findings provide preliminary evidence for the reliability of scores on the POLY and the validity of the POLY in predicting variables relevant to multitasking.

Contents

Development of a New Measure of Polychronicity

Polychronicity, as it is most generally defined, reflects the preference for multitasking as opposed to performing only a single task at a time (e.g., Slocombe & Bluedorn, 1999). Interest in polychronicity has increased dramatically over the past few years, perhaps most likely as a result of increased interest in and demand for multitasking in the workplace (Lindbeck & Snower, 2000). Due to many changes in the workplace such as the implementation of information technology, job enrichment, teamwork, and downsizing, the speed and nature of job performance is rapidly changing and traditional notions of job performance are now outdated for many jobs (Ilgen & Pulakos, 1999). Multitasking has now become an important component of job performance for many workers, and some authors have recently asserted that almost every job requires at least some degree of multitasking (Bühner, König, Pick, & Krumm, 2006). As such, organizational researchers have become interested of late in multitasking and associated predictor constructs such as polychronicity (Delbridge, 2001).

Because polychronicity likely reflects a combination of past experience with multitasking and a stable tendency to perceive multitasking as enjoyable and rewarding rather than stressful, it should be a particularly useful predictor of multitasking-related constructs. Polychronicity has been studied in relation to a wide variety of constructs including satisfaction, creativity, fit, and performance (e.g., Delbridge, 2001; Hecht & Allen, 2005; König, Bühner, & Mürling, 2005; Madjar & Oldham, 2006). Though many relationships between polychronicity and multitasking-related constructs make logical and theoretical sense, results of empirical studies exploring polychronicity in relation to these constructs have been quite mixed. The definition and measurement of polychronicity has been problematic in this literature, however, which in turn is likely to affect the interpretation of these results. As is often the case when a construct first begins to receive research attention, the conceptualization of polychronicity has been somewhat unclear. The literature has contained multiple definitions and methods of measurement for this construct. At best, this results in difficulty aggregating results such as in a meta-analysis; at worst, it results in a muddled picture of the relationships between polychronicity and related variables, calling relevant theory into question.

In an attempt to remedy some of these issues, the authors first review a current set of issues concerning definitions of polychronicity and then propose a new definition of polychronicity designed to address these problems. Next, they present three studies related to the development of a new measure of polychronicity, called the POLY. Results will be discussed with an eye toward the use of the POLY in future research. Finally, based on the work presented here, they propose several future research directions within the topic area.

Polychronicity: Some Definitional Issues

Cultural-level Definitions

In current organizational research, polychronicity is mainly used as an individual difference variable, yet the origins of polychronicity lie in the study of human cultures. Hall (1959) first defined polychronicity, and as an anthropologist his goal was to describe the extent to which a culture values performing multiple tasks at once. His research was very qualitative in nature; his descriptions of "polychronic" or "monochronic" cultures were rich and detailed, and his definition of polychronicity was multifaceted. Hall's descriptions of polychronicity not only captured the preference for engaging in multiple tasks at once but also the belief that this cultural preference is generally the "right way" to do things. Hall and his colleagues also included many qualitative descriptions that have very little to do with the performance of tasks (Hall & Hall, 1990). Palmer and Schoorman (1999) elaborated on three aspects of Hall and Hall's definition by proposing that cultural-level polychronicity consists of three components: time use preference, time tangibility, and context. Time use preference is the extent to which people within a culture prefer to do things one at a time or in coordination. Time tangibility is the extent to which time is perceived within a culture as being quantifiable (i.e., is time segmented or does it "flow"). In polychronic cultures, time "flows" and is not kept strictly by observance of the clock or of strict schedules.

The context component of Palmer and Schoorman's (1999) definition of polychronicity is somewhat more complex than the previous two. Communication within polychronic cultures is characterized as being "high context," meaning that information and meaning essential to a message are embedded in the context surrounding the message rather than simply within the message itself. To clarify this dimension, Hall gave the common example of attempting to tell a humorous story to a friend, eventually relenting by saying "I guess you just had to be there" (Hall, as interviewed by Bluedorn, 1998, p. 112). In contrast with polychronic cultures, monochronic cultures are seen as being "low context," which means that most of the information conveyed by a message is found within the message itself, and the surrounding context is unnecessary.

Another major cultural-level definition of polychronicity that has had perhaps the largest impact on subsequent research is that of Bluedorn, Kalliath, Strube, and Martin (1999). These authors defined polychronicity at the cultural level as "the extent to which people in a culture prefer to be engaged in two or more tasks or events simultaneously and believe their preference is the best way to do things" (p. 207). This definition has been especially influential because the most commonly used measure of polychronicity, the Inventory of Polychronic Values (IPV), was based on it. Other definitions have been offered at the cultural level (Onken, 1999; Persing, 1999; Slocombe, 1999; Slocombe & Bluedorn, 1999), but the essence of all of these definitions has been captured in those already discussed.

To summarize, polychronicity was originally defined at the cultural level rather broadly. Importantly, most definitions include both the preference for multitasking and the belief that others ought to multitask as well. As discussed earlier, researchers have recently become interested in applying the cultural construct of polychronicity to more micro levels such as the organization, the group, and the individual, and they have attempted to adopt the cultural definition of polychronicity either wholesale or in part at these levels as well.

Individual-level Definitions and Measurement

Definitions of polychronicity at the individual level have been highly varied and often quite complex as a result of researchers adopting some of the cultural level dimensions, leaving others out, and adding new concepts of their own. In addition, definitions of polychronicity at the individual level differ with respect to whether polychronicity is conceptualized as the preference for performing multiple tasks at once (e.g., Conte, Rizzuto, & Steiner, 1999; König, et al., 1999; Persing, 1999) or the actual behavior of doing so (e.g., Benabou, 1999; Bluedorn, Kaufman, & Lane, 1992; Cotte & Ratneshwar, 1999; Kaufman, Lane, & Lindquist, 1991).

For reasons of conceptual clarity and empirical modeling, both are important issues worth attending to. The various elements of cultural "context," or beliefs about whether others should multitask, are legitimate things to measure—but they do not measure individual beliefs or preferences. For this reason, the authors argue that it is inappropriate to include them in definitions or measures of polychronicity focused at the individual level. The IPV (Bluedorn et al., 1999) is the most popularly used measure of individual-level polychronicity, but it was initially developed as a measure of cultural-level polychronicity. Bluedorn et al suggested, and subsequent researchers have since adopted, the strategy of simply replacing "we" in the item stems with "I" to translate the scale to the individual level. The IPV is broad-based, containing items that address preference (e.g., "We like to juggle several activities at the same time"), behavior (e.g., "When we work by ourselves, we usually work on one project at a time," reverse-scored), and belief ("We believe people should try to do many things at once"). This is not problematic in and of itself, especially when the measure is used at the cultural level, but in instances where the measure has been used to assess individual polychronicity, these three components should be considered separately, both conceptually and in terms of their respective items' reliability and validity. It is not possible to examine these components separately, however, because researchers who use the scale typically use a modified or shortened version without providing rationale for or a description of items that are dropped or how and why the response scale is altered. This problem is what drives the need to develop a new scale of polychronicity that focuses solely on the component of polychronicity as an individual preference for multitasking.

In addition, the lack of definitional clarity with respect to whether polychronicity reflects a preference or a behavior is problematic. For example, a person may prefer to behave in a certain way (e.g., monochronic) yet may be forced or feel compelled to behave in a different manner (e.g., polychronic). In addition, a person may excel at one type of performance (e.g., multitasking performance) yet prefer performing a different way (e.g., single-task performance). A behavior-based definition of polychronicity is

nothing more than a repetition of the definition of multitasking performance, however, and thus the authors assert that it is essential for a definition of polychronicity, as an individual-differences construct independent of multitasking performance, to focus solely on preference for multitasking environments.

Resolving Definitional Issues

Given the problems discussed with respect to the current status of the definition and measurement of polychronicity, researchers believe it is most appropriate to address these issues by narrowing the definition of polychronicity, then developing a measure with item content that faithfully reflects that definition. Researchers have recently suggested that a key element of multitasking is the relatively quick shifting of attention among tasks, as measured objectively and through an individual's subjective perceptions (Oswald, Hambrick, & Jones, 2007). Thus, the definition offered here is that individual polychronicity is a non-cognitive variable *reflecting an individual's preference for shifting attention among ongoing tasks, rather than focusing on one task until completion and then switching to another task*. "Task" here is defined as a discrete set of activities engaged in for the purposes of attaining a goal, and can be considered and measured from relatively subjective and/or objective points of view (e.g., perceived speed vs. measured speed, complexity, or interdependence of tasks). This definition remedies the problems discussed above by focusing the definition on individual preference, by avoiding extraneous definitional artifacts from cultural-level definitions, and by keeping polychronicity as a preference conceptually and operationally distinct from multitasking performance. The authors now describe the development of a new measure of polychronicity, called the POLY, based on the newly proposed definition.

Development of the POLY

In Study 1, the authors first describe the initial stages of development of the POLY measure, along with a pilot study providing evidence for the reliability of scores on the POLY. In Study 2, they present results from a study investigating the convergent and discriminant validity of scores on the POLY. Finally, in Study 3, they report their efforts from a study providing information regarding face validity, content validity, and criterion-related validity of the POLY. In this study participants completed the POLY and measures of other multitasking-related constructs and then engaged in a computerized multitasking performance environment.

Study 1: Measure Development and Pilot Testing

Item Generation

The first step in the development of the POLY was to have a group of subject matter experts (SMEs) generate potential items. Five SMEs were selected due to their familiarity with the construct of multitasking. SMEs were provided with detailed item-

generation instructions, including the new definition of polychronicity. The instructions also included general guidelines for writing good survey items (e.g., “Create items that are clear and concise”). SMEs were asked to attempt to create items that reflected the entire potential continuum of polychronicity, from very low to very high. An attempt was made to create a large number of potential items, in order to sample as representatively as possible from the construct domain (Clark & Watson, 1995). In the end, SMEs created a total of 149 potential items that were then combined and reduced as follows.

Item Reduction

After compiling the list of potential items, those with nearly identical content were combined into single items. The first two authors then rated the remaining 136 items on clarity (1 = very unclear, 5 = very clear), construct relevance (1 = very irrelevant, 5 = very relevant), and level of polychronicity (1 = very low or monochronic, 5 = very high or polychronic). Items that were found to be unclear or irrelevant (i.e., a rating by either rater of less than 3 on a 1–5 scale for clarity or relevance) were discarded. This screening process resulted in the deletion of 111 items. Throughout the process, however, an awareness of the item content for items that were deleted and items that were kept was maintained by the authors and it was ensured that the deletion of items was not resulting in a content-deficient measure. At the end of this process, the pilot POLY measure thus consisted of 26 items.

Pilot Testing

Purpose

Pilot testing served three purposes. The first was to ensure the readability of the measure and to clear up any confusing items or directions; the second was to eliminate items that psychometrically were not functioning properly (e.g., ceiling or floor effects, or little contribution to alpha reliability), and the third was to examine the factor structure of the measure.

Sample

The POLY was pilot tested using a sample of 130 undergraduate students at a large Midwestern university who received credit in their psychology courses in exchange for their voluntary participation. All participants were between the ages of 18–22, 77 percent were female, and 87 percent were Caucasian. Because the POLY will primarily be used on college-age participants due to its likely future use in laboratory research on multitasking, this is an appropriate group to use for pilot testing (Dawis, 1987). It is important to note, however, that in order to establish the psychometric properties of POLY in various groups relevant to future research (e.g., older working-age individuals, military samples) more diverse samples will be required. Due to technical difficulties or non-response, data from 19 participants were discarded, resulting in a final sample size of 111.

Procedure

Participants signed up for the experiment through the psychology department's subject pool, and completion of the POLY was entirely online through the use of an online survey system. Respondents were asked to indicate to what extent they agreed or disagreed with each of the 26 statements (items) in the POLY measure. The scale was a 1–5 Likert-type scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree. In addition, participants responded to one yes/no item asking whether any items in the measure were repetitive and to one yes/no item asking whether any items were unclear, providing examples if an answer was "yes." Participants were also asked a third open-ended question allowing them to provide comments or input into further development of the measure.

Results

To address the first purpose of pilot testing, an analysis of the qualitative responses participants provided was performed. There was no indication from these responses that participants felt the items were unclear. Though a number of participants indicated that the items were somewhat repetitive, this was an expected result because the measure was in fact designed to tap the narrowly defined construct of preference for multitasking. Of those participants who provided a response to the open-ended "comments" question, 11 (10%) indicated that a less repetitive measure would be an improvement. Six participants (5%) mentioned that they had difficulty answering some of the questions because their preference for multitasking differed in different contexts (e.g., at school and at home). This is an interesting point, related to the difficulty in answering any trait measure (e.g., measures of the Big Five factors of personality), and situational effects should be explored in future research once the POLY trait measure is established. In a similar vein, three (3%) mentioned that asking questions about specific rather than general tasks (e.g., "checking email" versus "performing tasks") made the questions easier to answer. As a trait measure, the POLY aggregates responses across different situations, whenever situations are provided, but again, situational effects should be investigated in the future in a systematic manner. All open-ended responses fell into one of these three categories.

To address the second purpose of pilot testing, alpha reliability on the entire scale was first computed and was quite high (α = .88). Further statistics indicated that deleting any one of five items would increase alpha. An examination of these items indicated that all of these items were either worded rather strongly (e.g., "While I am driving, I prefer to have the radio off and everyone quiet so I can concentrate solely on driving.") or reflected such common behaviors for college students that not agreeing with an item would be rather unusual (e.g., "I like to talk on my cell phone while driving."). The means of the items in our sample supported this conclusion, being 3.94 for the three high-extreme items and 2.24 for the two low-extreme items (the mean for all other items, excluding these items, was 3.02). Because these items were so extreme, they operated more like a constant than a variable, and thus researchers decided to delete these items. Alpha was recomputed, and was higher at α = .90, acceptable given

the previously established goal of .80 for alpha (see Lance, Butts, & Michels, 2006, for an examination of the typically accepted .7 cutoff "myth" for reliability, suggesting that acceptable levels of alpha reliability should be higher).

To address the third purpose of pilot testing, researchers conducted a principal axis exploratory factor analysis (EFA) on the 21 remaining items to examine the factor structure of the POLY. This approach is similar to examining alpha reliability when an item is deleted (i.e., low item-total correlations will generally have low factor loadings as well), except that the EFA takes a more integrated approach by examining loadings simultaneously instead of examining separate alpha levels when each item is deleted. The items formed a single factor, as indicated by the scree plot indicating a clear break after the first factor, with one large eigenvalue explaining 35.52 percent of the total variance. Though item loadings for eight items were below Nunnally's (1978) recommended cutoff of .45, after examining the content of these items the authors chose to keep four of the items because deleting these items would have resulted in a measure that sacrificed important content and thus would be construct deficient. More specifically, without those items, the measure would have too few items asking about specific tasks (e.g., using a computer). In support for retaining these items, the item loadings were very close to the .45 cutoff (.41, .43, .44, and .44). Thus, only four items were deleted. A follow-up EFA was performed excluding these items, and as expected, a stronger 1-factor solution emerged, as evidenced by the scree plot and one large eigenvalue explaining 40.88 percent of the total variance. Thus, the 17-item version of the measure was retained for use in future analyses.

Discussion

The pilot study relied on a refined definition of polychronicity to begin developing and empirically refining the POLY. During this process, the researchers further reduced the number of items in the measure on conceptual, practical, and psychometric grounds while gathering evidence that the measure was sufficiently clear to participants. The refined POLY measure was based on this single sample of pilot data, and thus may have capitalized to some extent on sample-specific idiosyncrasies of the data. Appropriate evidence for the reliability and validity of the refined POLY needs to be carried out on independent samples of data, as will be described in two subsequent studies that were carried out.

Study 2: Convergent and Discriminant Validity

Purpose and Hypotheses

An essential part of developing any individual-differences measure of a relatively new construct, including the POLY, is establishing that a measure is conceptually and empirically distinct from measures of similar constructs, as well as from previous measures of the same construct. The Big Five factors of personality are routinely measured and used as non-cognitive variables predicting job performance outcomes and multitasking (e.g., König, et al., 2005). Therefore two of the Big Five factors were thought to be particularly relevant to polychronicity. Specifically, *extraversion* was

expected to be positively related to polychronicity due to the fact that individuals at higher levels of each of these constructs would tend to be drawn toward activities providing a high level of stimulation. Conversely, *neuroticism* was expected to be negatively related to polychronicity because people at higher levels of neuroticism tend to avoid highly stimulating activities such as those found in multitasking, and as such would be more likely to prefer activities *not* involving multitasking. Thus, it was hypothesized that

H1a: IPIP Extraversion will be positively correlated with POLY.

H1b: IPIP Neuroticism will be negatively correlated with POLY.

Need for cognition is a construct reflecting one's preference for engaging in activities requiring thought (Cacioppo & Petty, 1982; see also the construct of typical intellectual engagement, Goff & Ackerman, 1992). Polychronicity and need for cognition are both preferences that would potentially lead a person toward more complex tasks; however, it is argued here that they are conceptually and empirically distinct because they refer to different types of complexity: polychronicity refers to preference for complexity in terms of the number of tasks performed, and need for cognition refers more broadly to preference for complexity in terms of the amount of required cognitive processing. Thus, it should be clear that one may not necessarily prefer to engage in multiple tasks in order to prefer engaging in tasks requiring high levels of cognition, and vice versa. Thus,

H2: A measure of need for cognition correlate positively with POLY, but not so highly that they are indistinct (e.g., correcting for measurement error variance in the correlated variables leads to a correlation < 1.0).

Finally, although the new definition and measure of polychronicity proposed here are more specific than those used in the past, the POLY and past measures of polychronicity (the Polychronic Attitudes Index or PAI, Kaufman, et al, 1991; the Inventory of Polychronic Values or IPV, Bluedorn et al. 1999) all measure similar constructs in that they all measure some version of polychronicity. Thus,

H3: The IPV and the PAI will be positively correlated with the POLY, but not so highly that they are indistinct (e.g., correcting for measurement error variance in the correlated variables leads to a correlation < 1.0)

Methods

Sample

Participants were 192 different undergraduates at the same large Midwestern university who volunteered for the study in exchange for course credit. Demographic characteristics closely mirrored those of participants in Study 1.

Procedures

Participation in this study was entirely online. Participants first completed the 17-item POLY, refined from Study 1; then they completed two 10-item measures from the International Personality Item Pool (IPIP; Goldberg, 1999) to measure Neuroticism and Extraversion. Each IPIP item contained a statement such as "I often feel blue" or "I am the life of the party" as measures of Neuroticism and Extraversion, respectively. Participants rated how well each item describes them, using a 5-point scale. Participants then took the 18-item short form of the Need for Cognition scale (Cacioppo, Petty, & Kao, 1984). The measure consisted of a series of statements, such as "I would prefer complex to simple problems." Participants rated how well each item describes them using the same 5-point scale as the IPIP. Next participants completed both past measures of polychronicity, the PAI and the IPV (Bluedorn, et al., 1999; Kaufman, et al., 1991). Both these measures consist of a number of statements such as "I like to juggle several activities at the same time," to which participants also used the same 5-point scale.

Results

Internal consistency (alpha) reliabilities, means, standard deviations, and intercorrelations for scores on all measures are shown in Table 1. Alpha for the 17-item POLY was high at $\alpha = .88$. With respect to H1a, the bivariate correlation between the measure of extraversion and the POLY was $r = .17$, $p < .05$, providing support for this hypothesis. Regarding H1b, the bivariate correlation between neuroticism and the POLY was $r = -.09$, $p > .05$, failing to support this hypothesis. To test H2, the bivariate correlation between need for cognition and the POLY was calculated. The correlation of $r = .06$, $p > .05$ provided support for this hypothesis because the correlation was not in the range of practical significance, set at $|r| = .30$. To test H3a and H3b, the bivariate correlations between the POLY and the PAI and IPV were calculated. A moderate, positive correlation between the POLY and both the IPV and PAI would have provided support for H3. Correlations among the polychronicity measures, although high, were acceptable, $r = .67$, $p < .05$ for the PAI and $r = .80$, $p < .05$ for the IPV. Correlations corrected for measurement error variance were $r = .82$ and $r = .91$, respectively. Though these correlations are high, it is important to note that even though measures may correlate highly, they can still maintain statistically and practically significant differences with criteria. For example, even when two predictors correlate .90, and one of the predictors correlates .30 with a criterion measure, then mathematically, the other predictor can correlate anywhere from -.16 to .59 with the criterion.

Table 1
Study 2: Descriptive statistics, reliabilities, and intercorrelations

		M	SD	1	2	3	4	5	6
1	POLY	43.20	08.63	(.88)					
2	PAI	12.71	02.71	**.67**	(.76)				
3	IPV	27.91	05.62	**.80**	**.77**	(.85)			
4	Extraversion	34.47	06.75	**.17**	**.20**	.11	(.90)		
5	Neuroticism	28.17	06.05	-.09	-.10	-.09	**-.14**	(.83)	
6	Need for Cognition	57.48	09.30	.06	**.25**	**.14**	.03	**-.14**	(.88)

Note. N = 192. Scale alpha reliabilities are listed in parentheses on the diagonal.
Correlations in bold are significant at $p < .05$.

Discussion

Taken together, the results of this convergent/discriminant validity study provide support for the convergent validity of scores on the POLY to the extent that they are positively correlated with scores on past measures of polychronicity based on cultural conceptualizations. The POLY was also positively, yet weakly, correlated with scores on a measure of extraversion. Though the correlation between scores on the POLY and scores on a measure of neuroticism did not reach statistical significance, the correlation was low and in the hypothesized direction. Results of this study also provide support for the discriminant validity of the POLY, in that scores were relatively uncorrelated with scores on a measure of need for cognition. Finally, results of this study provide additional evidence of the internal consistency reliability of scores on the POLY through replication on an independent sample after the POLY measure was refined. In Study 3, presented next, the authors will describe efforts at establishing the criterion-related validity of scores on the POLY as well as replicating the results found thus far.

Study 3: Criterion-related Validity

Purpose and Hypotheses

In order to provide support for the theoretical underpinnings and practical uses of a measure of polychronicity, it is important to establish that it predicts relevant multitasking-related outcomes such as enjoyment of multitasking, state-based emotions such as excitement during multitasking, and the intention or decision to multitask in the future. Past research attempting to correlate polychronicity with multitasking performance—or more generally interest measures with job performance measures—have consistently failed to find relationships. Thus, our hypotheses are

H4a: POLY will be positively correlated with enjoyment of the multitasking simulation.

H4b: POLY will be positively correlated with excitement during the multitasking simulation.

H4c: POLY will be positively correlated with the number of tasks participants choose to perform at once, given a choice.

Sample

Participants were undergraduates from the same Midwestern university, who received course credit in their psychology courses in exchange for their voluntary participation, and again, demographic characteristics closely mirrored those of Studies 1 and 2. The total sample size was 159, though the sample size for analyses performed ranged from 127 to 152 because some participants were missing data from parts of the experiment.

Procedure

Participants signed up for the experiment online, at which time they took the POLY online as a "pretest." After taking the POLY, participants were administered a 5-item measure of face validity (Smither, Reilly, Millsap, Pearlman, & Stoffey, 1993). The measure included the definition of polychronicity proposed in this paper, followed by statements such as "The actual content of the survey was clearly related to polychronicity." Ratings were made on a 5-point Likert-type scale ranging from Strongly Disagree to Strongly Agree. In addition, participants were asked to indicate whether the items were unclear or repetitive, also on a 5-point Likert-type scale. Approximately one week later, participants completed the remainder of the experiment in a laboratory setting in groups of five to eight individuals. The experiment occurred in two main sections. During the first section, participants completed the POLY and measures of the other personality variables involved in the study. During the second section, participants received instructions about a computerized multitasking simulation and then performed the simulation.

Section 1: Measures

As with the above studies, participants first completed a number of measures online, however, this time the online survey was taken in small groups in a proctored computer lab. As before, participants completed measures of extraversion, neuroticism, need for cognition, the PAI, the IPV, and the POLY.

Section 2: Multitasking Simulation

Following the administration of the measures, participants began the multitasking simulation. The multitasking simulation used was SynWin, a "synthetic" work task which contains four component tasks that are presented simultaneously (see Figure 1; Elsmore, 1994). The tasks are *memory search, arithmetic, visual monitoring,* and *auditory monitoring*. In the memory search task, a set of letters is presented for a short time and then covered. Subsequently a letter is presented and participants identify whether or not the letter was a part of the previously shown set. Participants may click the area where the list appeared to reveal the letter set again, but doing so carries a

point penalty. In the arithmetic task, participants add 2-digit or 3-digit numbers. As soon as one addition task is completed, another addition task appears in this quadrant. This task is performed at the participant's own pace; there are no time constraints. In the visual monitoring task, a needle moves from right to left across a gauge that resembles a fuel gauge. Participants must click on the gauge to reset the needle before it reaches zero. More points are given for the needle being as close to zero as possible and points are lost proportional to the length of time the needle stays at zero. In the auditory monitoring task, participants must respond to a higher-pitch target tone and ignore a lower-pitch distracter tone. Participants performed the multitasking simulation for two 10-minute blocks.

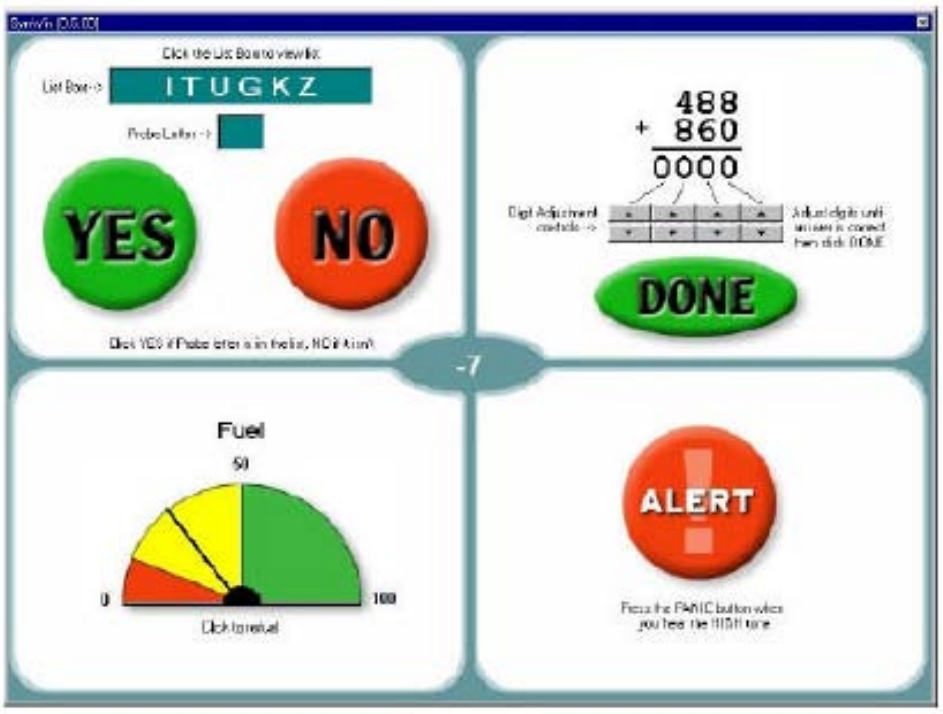

Figure 1.SynWin Screen Shot.

After completing the multitasking simulation, participants were given measures assessing their enjoyment of the multitasking simulation and their level of excitement during the simulation. After completing these measures, participants were asked to imagine that the researchers needed four more minutes of performance data from them, but they were free to choose how many tasks of SynWin they would perform at once. Participants were asked to indicate whether they would like to perform one, two, three, or all four tasks at a time. They were then asked an open-ended question regarding why they chose the number of tasks they chose. Participants did not actually have to perform these tasks, and were then thanked for their participation and excused.

Results

Reliability

Internal consistency (alpha) reliabilities, means, standard deviations, and intercorrelations for all measures are reported in Table 2. As can be seen, internal consistency reliability and convergent/discriminant validity evidence remained similar to that found in the previous studies. In order to establish that items were still functioning as expected, item-remainder correlations were also examined. Three items had quite low item-remainder correlations (under .35). After once again examining the content of the items in the measure, researchers removed these items because they concluded that it would not adversely affect content validity because similar content was reflected in other items. Thus, they were excluded from the measure for further analyses. By contrast, two other items also had low item-remainder correlations (.38 and .39) but were kept because researchers concluded that deleting them would have resulted in construct deficiency. Alpha for the 14-item measure (see Table 3 for a complete listing of items) was slightly higher at $\alpha = .91$. Test-retest reliability, as estimated by the correlation between scores on the 14-item POLY at Time 1 (online sign-up) and scores on the 14-item POLY at Time 2 (lab session, approximately one week later) was $r = .83$ which was considered quite high.

Table 3
Study 3: Descriptive Statistics, Reliabilities, and Intercorrelations

		N	M	SD	1	2	3	4	5	6	7	8	9	10	11
1	**POLY Pretest (17)**	127	52.74	9.08	(.88)										
2	**POLY Pretest (14)**	130	41.95	8.21	**.98**	(.89)									
3	**POLY (17)**	147	53.37	9.51	**.85**	**.83**	(.90)								
4	**POLY (14)**	149	42.54	8.56	**.82**	**.83**	**.98**	(.91)							
5	**PAI**	152	13.29	2.66	**.62**	**.62**	**.73**	**.74**	(.80)						
6	**IPV**	151	29.42	6.12	**.75**	**.76**	**.85**	**.84**	**.79**	(.89)					
7	**Extraversion**	152	35.28	6.05	.02	.05	.12	.14	**.17**	.08	(.88)				
8	**Neuroticism**	150	26.58	6.39	.02	-.01	-.07	-.11	**-.20**	-.15	**-.25**	(.88)			
9	**Need for Cognition**	147	60.27	9.94	-.05	-.08	.06	.04	**.20**	.09	**.16**	**-.22**	(.91)		
10	**Excitement**	150	30.70	6.54	.00	-.05	.08	.04	-.03	.00	-.07	-.07	**.23**	(.82)	
11	**Enjoyment**	150	13.20	3.26	**.17**	.13	**.31**	**.28**	**.31**	**.30**	-.12	-.06	**.28**	**.42**	(.83)
12	**Choice**	152	3.20	.91	.02	.01	**.18**	**.17**	**.29**	**.22**	**.34**	**-.22**	**.33**	.12	**.57**

Note. Scale alpha reliabilities are listed in parentheses on the diagonal. Correlations in bold are significant at $p < .05$.
Numbers in parentheses for POLY measures are the number of items in the measure.

Table 3
Item Content for 14-Item POLY

1. I prefer to work on several projects in a day, rather than completing one project and then switching to another.
2. I would like to work in a job where I was constantly shifting from one task to another, like a receptionist or an air traffic controller.
3. I lose interest in what I am doing if I have to focus on the same task for long periods of time, without thinking about or doing something else.
4. When doing a number of assignments, I like to switch back and forth between them rather than do one at a time.
5. I like to finish one task completely before focusing on anything else. (R)
6. It makes me uncomfortable when I am not able to finish one task completely before focusing on another task. (R)
7. I am much more engaged in what I am doing if I am able to switch between several different tasks.
8. I do not like having to shift my attention between multiple tasks. (R)
9. I would rather switch back and forth between several projects than concentrate my efforts on just one.
10. I would prefer to work in an environment where I can finish one task before starting the next. (R)
11. I don't like when I have to stop in the middle of a task to work on something else. (R)
12. When I have a task to complete, I like to break it up by switching to other tasks intermittently.
13. I have a "one-track" mind. (R)
14. I prefer not to be interrupted when working on a task. (R)

Note. Items followed by (R) are reverse-scored.

Face and Content Validity

The mean face validity rating across items was 3.5, meaning that overall participants agreed that the POLY reflected the construct of polychronicity as defined here. Content validity was also assessed by having five SMEs rate the extent to which the 14-item POLY reflected the construct of polychronicity in its entirety. As an index of interrater agreement, researchers computed an Intra-Class Correlation (ICC[1]), which indicates the amount of variance in ratings that is shared among raters (McGraw & Wong, 1996). The ICC(1) for content validity ratings was .85 . Because ICC values are comparable to reliability coefficients, an ICC(1) of .7 or greater was set as the cutoff. Thus, there was

substantial enough agreement to merit combining the ratings (LeBreton, Burgess, Kaiser, Atchley, & James, 2003). The mean content validity rating was 4.53, which was considered acceptable for the same reason as the face validity ratings.

Criterion-related Validity

To test H4a, enjoyment of the multitasking simulation was included as the criterion in a simple linear regression with POLY as the predictor. In support of H4a, the POLY was a significant predictor of enjoyment, standardized β = .28, $F(1,147) = 12.24$, $p < .05$, $R^2 = .08$. To test H4b, a simple linear regression was performed with excitement during the multitasking simulation as the criterion and POLY as the predictor. The analysis failed to provide evidence that the POLY was a significant predictor, standardized β = .04, $F(1,146) = .24$, $p = .64$, $R^2 = .00$, and thus H4b was not supported. To test H4c, the number of tasks participants choose to perform during the "extra" 4-minute performance session was included as the criterion in a simple linear regression with POLY as the predictor. In support of the hypothesis, the POLY was a significant predictor of the number of tasks chosen, standardized β = .17, $F(1,148) = 4.40$, $p < .05$, $R^2 = .03$. With respect to the effect sizes (R^2 values) associated with both of the significant effects, though the effect sizes may be considered small by typical conventions, researchers felt that they were sufficiently high to provide support for our hypotheses due to the multiply determined nature of both enjoyment and task choice. Though it was not hypothesized, they also tested whether the POLY was a significant predictor of performance at multitasking and found that it was not, β = .07, $F(1,150) = .66$, $p = .42$, $R^2 = .00$.

Discussion

Study 3 provided additional evidence of the internal consistency reliability and convergent/discriminant validity of scores on the POLY in a third independent sample, which also allowed for an additional refinement of the measure. The study provided evidence in support of test-retest reliability, face validity, content validity, and criterion-related validity of scores on the POLY. In addition, the findings that the POLY predicted enjoyment of a multitasking simulation and the number of tasks participants would choose to perform if given the chance are each important and interesting contributions to the literature on multitasking and polychronicity.

General Discussion

This paper reviewed definitional issues with respect to polychronicity, proposed a new definition of polychronicity, and described the construction of a measure of polychronicity (the POLY) based the new definition. In three studies, it has been shown that scores on the POLY exhibit acceptable levels of reliability and validity. With respect to reliability, scores on the POLY were found to exhibit high test-retest and internal consistency reliability. Though extremely high levels of internal consistency may sometimes be of concern if they reflect a measure that is too narrow, high levels of

reliability (e.g., .91) are appropriate in this case because the POLY was designed to tap a focused construct, that is, preference for multitasking activities. In addition, the high test-retest reliability provides some evidence that the POLY measures a stable characteristic over time. With respect to validity, scores on the POLY were tested in relation to a number of pieces of evidence. The content validity of scores on the POLY was rated by experts and found to be satisfactory. The high ratings received by the POLY with respect to content validity reflect the fact that the items within the measure each tap the construct of polychronicity (and nothing else), and that as a set, the items reflect the entire content domain of polychronicity. In addition, face validity ratings were found to be acceptable.

With respect to convergent and discriminant validity, scores on the POLY showed promising evidence of prediction unique from scores on measures of related constructs. Scores on the POLY were unrelated to scores on a measure of need for cognition and significantly related to scores on a measure of extraversion, as was expected. Though the correlation between scores on the POLY and a measure of neuroticism did not reach the level of significance in the present study, the relationship was in the anticipated direction. Though it is impossible to make conclusions on the basis of non-significant relationships, this trend suggests the possibility that in a study with a greater sample size, this relationship might in fact become significant. Finally, the POLY showed high correlations with past measures of polychronicity, the PAI and IPV.

With respect to criterion-related validity, though scores on the POLY did not predict excitement during the multitasking simulation, they did significantly predict both enjoyment of the simulation and the number of tasks participants would have chosen to perform, had they been given the chance. A side note here is that after they chose how many tasks they would like to perform if the experimenters had asked them to perform one more SynWin block, participants were asked why they chose the amount of tasks they chose. A purely exploratory investigation into these responses provides some interesting information. For participants who indicated that they would like to perform four tasks (the maximum number of tasks, n = 69), the most frequently reported answers were that doing so would be challenging (n = 12), that they were simply comfortable (n = 11) doing four tasks at once, or that any fewer would be boring (n = 10). These data suggest that perhaps highly polychronic people might derive more personal fulfillment from jobs requiring higher levels of multitasking, would be more satisfied with them, and would be left unsatisfied with or bored by jobs that do not allow them to multitask.

This finding has potential practical significance with respect to the POLY and to polychronicity in general because it speaks to the potential usefulness of polychronicity as a placement tool for jobs requiring high levels of multitasking, such as air traffic controller. An individual high in polychronicity, because he or she might enjoy the multitasking component more than an individual low in polychronicity, might find these jobs more rewarding on the whole. Though it is purely speculative, one might infer that these individuals would also be less likely to burn out or turn over from these jobs due to their general enjoyment of them. Regarding how to make multitasking-based job classification operational, the O*NET database (see http://online.onetcenter.org) contains variables that characterize occupations on a whole host of worker and work characteristics, including characteristics related to multitasking such as information

ordering (following rules in a prescribed order), speed of closure (speed in making sense out of a lot of information), flexibility of closure (detecting patterns in the midst of distractions), time sharing (shifting between two or more sources of information), and reaction time (speed of responding to signals). Composite scores, based on these O*NET variables, could be used to rank jobs in terms of their multitasking requirements, and individuals could be classified into those jobs based on their multitasking interests and/or their multitasking performance.

Of course the findings in this study with respect to such satisfaction-related outcomes are only preliminary; however, the knowledge that such relationships are possible should prove useful in future research, which will be discussed later. Taken together, the measure evaluation findings indicate that the POLY shows clear evidence of reliability, some evidence of various types of validity, and promise as a predictor of multitasking-related outcomes.

Limitations and Future Directions

The present study possessed some potential limitations that could be addressed by future research. First, the sample used in the present study was restricted to college undergraduates, a sample whose generalizability to the college population is obvious, but whose generalization to the adult workforce at large is questionable in some respects. For instance, it is probably safe to assume that our participants on the whole were less motivated to perform the multitasking task to the best of their ability than might individuals multitasking at work, because it had no bearing on any meaningful future outcome for them. That said, the data do not show floor effects in their performance, though perhaps there was reduced variance that may have attenuated the correlations between multitasking performance and other variables in the study.

A second limitation of the present sample is the age of the participants. Research has shown that multitasking ability decreases with age (e.g., Salthouse, Hambrick, Lukas, & Dell, 1996), and as such the results of multitasking studies performed with participants of college age may not generalize well to age-diverse populations. In fact, polychronicity scores may also fall with age because as multitasking becomes more difficult with age, interest in multitasking may decline. Though the present sample was reasonable for this study, given the need to conduct initial steps in measure development and validation, future studies should attempt to replicate the reliability and validity findings of this study using more diverse samples, particularly in terms of age, motivation, and work experience.

A final limitation of this study is its use of self-report measures for all variables. Relationships in the study measures may have been inflated due to common method variance. Participants filled out all the measures in the same format (an online survey) with very similar response scales for all measures. This problem is compounded by the fact that the relationships of interest are likely to be small in magnitude, and as such even a small degree of common method variance might result in conclusions that are not merited. In the future, researchers might also consider supplementing perceptual measures with a number of different behavioral outcomes. For example, to measure task choice, one might provide participants with a number of choices of tasks to perform

while they wait for the experimental session to start. By varying the task choices and collecting data on which participants choose which activities, researchers could assess actual choice behavior rather than intentions in a hypothetical situation. Another possibility for a behavioral measure is to collect data on career choices with respect to their level of multitasking and determining whether factors like polychronicity predict the choice of a career track high in multitasking (e.g., air traffic controller).

In addition to future directions suggested by limitations in the present study, a final direction for future research is suggested by the results of this study. Instead of focusing on performance at multitasking, polychronicity researchers might find stronger relationships by focusing on satisfaction- or fulfillment-related outcomes. These outcomes are important because workers who are more satisfied or fulfilled by their jobs, or who experience greater levels of fit with their job and the organization as a whole, may be more motivated and less likely to burn out or leave the organization (e.g., Mathieu, 1991). An important consideration here is that ability or intelligence may play a role in the type or degree of multitasking an individual finds rewarding or challenging as well, suggesting that interaction effects between multitasking preference and skill might be profitably investigated. More generally, future research should integrate polychronicity into broad models of person-job and person-organization fit.

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